

MECHANICAL ENGINEERING (ME)

100 Level Courses

ME 151: *Practicum in Engineering*. 2 credits.

This course provides students with experiences in algorithmic thinking, visualization and communications. An essential component of this course is preparation of students for the National Academy of Engineering Grand Challenge Scholars Program. Offered by Mechanical Engineering. Limited to two attempts.

Schedule Type: Laboratory

200 Level Courses

ME 211: *Statics*. 3 credits.

An initial course in applied vector mechanics with emphasis on static equilibrium. Topics include forces, moments, couples, equivalent force-couple systems, centroids, distributed forces, and Coulomb friction. The application of the free body diagram in the analysis of static equilibrium of frames, machines and trusses is stressed. Offered by Mechanical Engineering. Limited to two attempts.

Registration Restrictions:

Required Prerequisites: PHYS 160^C and 161^C.

^C Requires minimum grade of C.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Lecture

ME 212: *Solid Mechanics*. 3 credits.

A first course in mechanics of deformable bodies with emphasis on the engineering approach to the responses of these bodies to various types of loadings. Topics include stress-strain relationships, stress-strain analysis, stress and strain transformation (Mohr's circle), load-deflection, bending, torsion, buckling, and thermal effects. Offered by Mechanical Engineering. Limited to two attempts.

Recommended Corequisite: MATH 214.

Registration Restrictions:

Required Prerequisite: ME 211^C.

^C Requires minimum grade of C.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Lecture

ME 221: *Thermodynamics*. 3 credits.

A basic thermodynamics course in which the first and second laws of thermodynamics are studied primarily from the classical macroscopic viewpoint and applied to both closed and open systems. Working substances include perfect gases, real gases and vapors in addition to solids and liquids. Offered by Mechanical Engineering. Limited to two attempts. Equivalent to ENGR 307.

Registration Restrictions:

Required Prerequisite: MATH 113^C.

^C Requires minimum grade of C.

Students with a class of Freshman may **not** enroll.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Lecture

ME 231: *Dynamics*. 3 credits.

A course in classical vector dynamics. Topics include vector algebra and calculus, kinematics and kinetics of particles and rigid bodies, as well as energy and momentum methods. Extensive problem solving involving particle and rigid body motion is required. Offered by Mechanical Engineering. Limited to two attempts.

Recommended Corequisite: MATH 214.

Registration Restrictions:

Required Prerequisite: ME 211^C.

^C Requires minimum grade of C.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Lecture

300 Level Courses

ME 311: *Mechanical Experimentation I*. 1 credit.

Experimental measurements in solid mechanics and materials science. Involves technical report writing. Offered by Mechanical Engineering. Limited to two attempts.

Recommended Corequisite: ME 313.

Registration Restrictions:

Required Prerequisite: ME 212^C.

^C Requires minimum grade of C.

Enrollment is limited to students with a major in Mechanical Engineering.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Laboratory

ME 313: *Material Science*. 3 credits.

An introductory course in physical and mechanical properties of engineering design materials, ceramics and plastics, their structures, use in engineering applications and failure phenomena. Offered by Mechanical Engineering. Limited to two attempts.

Registration Restrictions:

Required Prerequisites: CHEM 211^C or 251^C.

^C Requires minimum grade of C.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Lecture

ME 321: *Mechanical Experimentation II*. 1 credit.

Experimental measurements in fluid mechanics and heat transfer. Involves technical report writing. Offered by Mechanical Engineering. Limited to two attempts.

Recommended Corequisite: ME 323.

Registration Restrictions:

Required Prerequisite: ME 322^C.

^C Requires minimum grade of C.

Enrollment is limited to students with a major in Mechanical Engineering.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Laboratory

ME 322: Fluid Mechanics. 3 credits.

An introductory course in fluid dynamics stressing both the integral and differential forms of the conservation laws of fluid flow. Engineering applications are made to hydrostatics and to ideal and real fluid flows. Offered by Mechanical Engineering. Limited to two attempts.

Registration Restrictions:

Required Prerequisite: ME 221^C.

^C Requires minimum grade of C.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Lecture

ME 323: Heat Transfer. 3 credits.

Study of thermal radiation, steady and transient conduction, laminar and turbulent convection, internal and external flow, boundary layers and empirical correlations. Applications address fins, nuclear reactor cooling, heat exchangers and interactive computing. Offered by Mechanical Engineering. Limited to two attempts.

Registration Restrictions:

Required Prerequisite: ME 322^C.

^C Requires minimum grade of C.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Lecture

ME 341: Design of Mechanical Elements. 3 credits.

Fundamentals of mechanical design. Introduction to the fundamentals of static and fatigue failure theories, design of basic machine elements such as fasteners, bearings, gearing and shafts. Builds on the fundamentals of design introduced in earlier courses by introducing the concepts of customer requirements, specification development, reverse engineering, functional decomposition, and design for manufacturing. Offered by Mechanical Engineering. Limited to two attempts.

Registration Restrictions:

Required Prerequisite: ME 212^C.

^C Requires minimum grade of C.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Lecture

ME 342: Design of Thermal Systems. 3 credits.

A study of equipment which operates on principles of thermodynamics and fluid mechanics is used to reinforce analyses and design of gas and vapor power cycles, refrigeration and air conditioning, propulsion

systems, combustion, energy conversion and compressible flow. Offered by Mechanical Engineering. Limited to two attempts.

Registration Restrictions:

Required Prerequisite: ME 221^C.

^C Requires minimum grade of C.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Lecture

ME 351: Analytical Methods in Engineering. 3 credits.

Survey of advanced mathematics topics needed in the study of engineering. Topics include vector differential and integral calculus, matrix analysis, partial differential equations, complex variables, numerical methods, data analysis using statistics and probability theory. Offered by Mechanical Engineering. Limited to two attempts.

Registration Restrictions:

Required Prerequisite: (MATH 214^C).

^C Requires minimum grade of C.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Lecture

ME 352: Entrepreneurship in Engineering. 3 credits.

Introduces students to the concept of entrepreneurship and how to translate technical skill sets to commercial success. Topics include creating a business plan, pitching ideas, risk mitigation, and selecting investment alternatives. Emerging technology related to Mechanical Engineering will be analyzed in this context. Offered by Mechanical Engineering. Limited to two attempts.

Recommended Prerequisite: Completion of at least 15 credits hours in major courses.

Registration Restrictions:

Enrollment limited to students with a class of Junior, Senior Plus or Senior.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Lecture

400 Level Courses

ME 431: Systems Dynamics. 3 credits.

A first course which deals with the mathematical modeling of dynamic systems and response analysis of these systems. Topics include state variable and transfer functions, mathematical analysis of systems response, and the use of computational tools for modeling, design, and simulation. Offered by Mechanical Engineering. Limited to two attempts. Equivalent to ME 380.

Registration Restrictions:

Required Prerequisites: (ME 231^C) and (PHYS 260^C or 261^C).

^C Requires minimum grade of C.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Lecture

ME 432: Control Engineering. 4 credits.

Introduces fundamentals of feedback and modern control theory. Topics include analysis of mechanical and thermal systems by root locus and frequency response techniques. Use of sensors and transducers in control systems, data acquisition and analysis. Offered by Mechanical Engineering. Limited to two attempts.

Registration Restrictions:

Required Prerequisite: ME 351^C.

^C Requires minimum grade of C.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Lecture

ME 443: Mechanical Design I. 3 credits.

The first course in a two-semester capstone design sequence. Topics include the engineering design process, project management, codes and standards, engineering ethics, and computer-aided design. Students form design teams, select a capstone design project and progress through the proposal and preliminary design stages of the project. The capstone design project continues in ME 444. Offered by Mechanical Engineering. Limited to two attempts. Equivalent to ME 360.

Registration Restrictions:

Required Prerequisite: ME 323^C.

^C Requires minimum grade of C.

Enrollment is limited to students with a major in Mechanical Engineering.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Lecture

ME 444: Mechanical Design II. 3 credits.

The second of the two-semester capstone design course sequence. Students continue with concept selection, detail design, prototyping and evaluation of their major design projects. Formal presentations and reports are prepared to review and document the designs. Offered by Mechanical Engineering. Limited to two attempts.

Mason Core: Capstone

Specialized Designation: Writing Intensive in the Major

Registration Restrictions:

Required Prerequisite: (ME 443^C).

^C Requires minimum grade of C.

Enrollment is limited to students with a major in Mechanical Engineering.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Lecture

ME 453: Developing the Societal Engineer. 2 credits.

A course which highlights, through speakers, discussions and workshops, the professional responsibility of a being mechanical engineer. Additional topics that will be covered include ethical issues, current events and trends in the profession. Engineering case studies will be explored. Offered by Mechanical Engineering. Limited to two attempts.

Registration Restrictions:

Required Prerequisite: ME 443^{*C}.

^{*} May be taken concurrently.

^C Requires minimum grade of C.

Enrollment is limited to students with a major in Mechanical Engineering.

Students with the terminated from VSE major attribute may **not** enroll.

Schedule Type: Lecture

ME 498: Independent Study in Mechanical Engineering. 0-3 credits.

Directed self-study of topics of special interest. Offered by Mechanical Engineering. May be repeated within the term for a maximum 6 credits.

Schedule Type: Independent Study

ME 499: Special Topics in Mechanical Engineering. 0-4 credits.

Topics of special interest to undergraduates. Notes: May be repeated for credit when topic is different. Offered by Mechanical Engineering. May be repeated within the term for a maximum 12 credits.

Registration Restrictions:

Enrollment limited to students with a class of Senior Plus or Senior.

Enrollment is limited to students with a major, minor, or concentration in Mechanical Engineering.

Schedule Type: Lecture

500 Level Courses

ME 521: Energy Transfer. 3 credits.

Study of thermal fluid sciences related to energy systems. Provides foundations in thermodynamics, mass transfer, fluid mechanics, and heat transfer in steady systems. Covers modelling and analysis of engineering devices such as pumps, heat exchangers, turbines, and airfoils which constitute energy systems. Offered by Mechanical Engineering. May not be repeated for credit.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Lecture

ME 531: Energy Transmission. 3 credits.

Introduces analysis of local and national electrical grids used for power transmission and develops understanding of economic constraints on energy systems. Students will model energy transmission systems with dynamic loads ensuring energy security and optimal performance. Advanced topics such as forecasting for renewable energy integration,

smart grid implementation, and utilization of emerging energy storage technology are covered. Offered by Mechanical Engineering. May not be repeated for credit.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Lecture

ME 541: Power Generation. 3 credits.

Study of traditional and advanced power generation technology. Builds upon conservation principles of mass, energy, and momentum to analyze, model and optimize energy systems based on physical principles. Specific attention will be paid to site specific conditions for generation. Advanced cycles will be covered which utilize fossil fuel, renewable, and nuclear energy. Offered by Mechanical Engineering. May not be repeated for credit.

Recommended Prerequisite: ME 521.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Lecture

ME 542: Energy Utilization. 3 credits.

Covers energy utilization by end users. Technology and system integration are covered for applications such as combined heat power units and transportation. Students will use energy audit techniques to identify and minimize energy losses from the demand side. Investment, payback, and subsidies for purchasing energy system updates will be evaluated. Offered by Mechanical Engineering. May not be repeated for credit.

Recommended Prerequisite: ME 521.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Lecture

600 Level Courses

ME 621: Foundations of Fluid Mechanics. 3 credits.

Derivation of the fundamental equations of fluid mechanics, including the Navier-Stokes equations, conservation of mass, and the vorticity transport equations. Vector and Cartesian tensor notation are used throughout. Equations of motion are applied to incompressible viscous and inviscid flows. Some aspects of turbulence are discussed. Offered by Mechanical Engineering. May not be repeated for credit.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Lecture

700 Level Courses

ME 714: Fracture Mechanics. 3 credits.

Investigation of linear elastic and elastic-plastic fracture mechanics. Topics include: theory of elasticity and plasticity, energy and stress approach to fracture mechanics, methods to determine the stress intensity factor, fracture mechanics testing, fatigue crack growth. Develop a basic understanding of how crack-like defects impact performance in structures and learn how to select materials to ensure damage tolerance. Offered by Mechanical Engineering. May not be repeated for credit.

Recommended Prerequisite: Introductory graduate level course in advanced strength of materials or theory of elasticity, or consent of the instructor.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Lecture

ME 715: Impact Dynamics. 3 credits.

Includes advanced dynamics of impact, impact biomechanics, as well as vehicle crashworthiness standards and accident data analysis. Students will learn about FMVSS and NCAP crash tests. FARS and NASS real world accident databases, and methods to analyze crash and accident data. Offered by Mechanical Engineering. May not be repeated for credit.

Recommended Prerequisite: ME 231, ME 212 or equivalent courses.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Lecture

ME 722: *Introduction to Turbulence*. 3 credits.

Introduces beginning graduate students to the theory of turbulence. The theory of homogeneous-isotropic turbulence is introduced, followed by a discussion of sheared and wall-bounded turbulence. Some aspects of coherent structures in turbulence will be introduced as well as models used in computing turbulence. Specially designed projects are intended to enable students to apply what they have learned to different flow situations. Offered by Mechanical Engineering. May not be repeated for credit.

Recommended Prerequisite: ME 621.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Lecture